

Analysis of Technical and Tactical Movements Performed in the 2021 and 2022 Senior Freestyle Wrestling World Championships

2021 ve 2022 Büyükler Serbest Güreş Dünya Şampiyonalarında Gerçekleştirilen Teknik ve Taktik Hareketlerin Analizi

*Ali Kamil GÜNGÖR¹, Ramiz ARABACI²

¹ Bursa Uludağ University, Faculty of Sport Sciences, Bursa, TÜRKİYE / alikamilgungor@uludag.edu.tr / 0000-0001-5875-0742

² Bursa Uludağ University, Faculty of Sport Sciences, Bursa, TÜRKİYE / ramizar@uludag.edu.tr / 0000-0001-8403-5742

* Corresponding author

Abstract: This study aimed to perform a notational analysis to examine the technical and tactical aspects of elite male wrestlers participating in the 2021 and 2022 Senior World Wrestling Championships. A total of 598 bout videos were observed and analyzed using the Dartfish Connect Plus 8.0 match analysis program. The analyses were conducted in four stages using the Dartfish Connect Plus 8.0 software: preparation, tagging, database creation, and reporting. Wrestling techniques were categorized into takedowns and throws (standing position) and flips and throws (parterre position). A significant difference was found between attack and counterattack techniques between the 2021 and 2022 World Championships ($p < 0.05$; $\chi^2 = 8.318$). The mean technical points (TPmean) recorded during the first and second periods were 5.2 and 4.4, respectively, in the 2021 World Championship ($p > 0.05$, $d = 0.071$), while the mean number of wrestling actions (WAmeyn) was 1.78 and 1.73 ($p > 0.05$, $d = 0.068$) for the same periods. In the 2022 World Championship, TPmean was recorded as 5.1 and 4.4 ($p > 0.05$, $d = 0.061$), and WAmeyn as 1.77 and 1.76 ($p > 0.05$, $d = 0.001$) for the first and second periods, respectively. The majority of wrestling techniques were performed in the standing position (61.4% in 2021 and 58.6% in 2022). The findings of the present study demonstrated the dynamic and active nature of wrestling in the 2021 and 2022 World Championships. Furthermore, leg attacks, takedowns, push-outs, and gut wrenches were identified as the most valuable techniques in elite freestyle wrestling.

Keywords: Wrestling, notational analyses, technic-tactic, elite athlete.

Özet: Bu çalışmada, 2021 ve 2022 Büyükler Dünya Güreş Şampiyonaları'nda elit düzeydeki erkek güreşçilerin teknik ve taktiksel yönlerini incelemek için bir notasyon analizi yapılması amaçlanmıştır. Toplamda 598 müsabaka videosu Dartfish Connect Plus 8.0 maç analizi programı kullanılarak incelenmiş ve analiz edilmiştir. Analizler, Dartfish Connect Plus 8.0 programı kullanılarak dört aşamada gerçekleştirilmiştir: hazırlık, etiketleme, veri tabanı oluşturma ve raporlama. Güreş teknikleri, ayakta pozisyonda yapılan teknikler (ayağa dalma ve fırlatmalar) ve parter pozisyonunda yapılan teknikler (çevirmeler ve fırlatmalar) olmak üzere gruplandırılmıştır. 2021 ve 2022 Dünya Şampiyonaları arasında ataklar ve kontra-ataklar açısından 2022 Dünya şampiyonası lehine anlamlı bir fark bulunmuştur ($p < 0.05$; $\chi^2=8.318$). 2021 Dünya Şampiyonası'nda birinci ve ikinci periyotlardaki ortalama teknik puan (TPort) sırasıyla 5.2 ve 4.4 ($p > 0.05$, $d = 0.071$) olarak, güreş hareketleri açısından ortalama değerler (GHort) ise 1.78 ve 1.73 ($p > 0.05$, $d = 0.068$) olarak belirlenmiştir. 2022 Dünya Şampiyonası'nda ise TPort sırasıyla 5.1 ve 4.4 ($p > 0.05$, $d = 0.061$), GHort ise 1.77 ve 1.76 ($p > 0.05$, $d = 0.001$) olarak tespit edilmiştir. Güreş tekniklerinin büyük bir çoğunluğunun ayakta pozisyonda uygulandığı görülmüştür (2021 Dünya Şampiyonası %61,4; 2022 Dünya Şampiyonası %58,6). Bu çalışmanın bulguları, 2021 ve 2022 Dünya Şampiyonaları'nda sergilenen güreşlerin aktif bir mücadele yapısına sahip olduğunu göstermiştir. Elit serbest stil güreşte en değerli teknikler arasında ayak dalışı, ayakta indirme, dışarı itme ve ters kilit çevirme olduğu görülmüştür.

Anahtar Kelimeler: Güreş, notasyonel analiz, teknik-taktik, elit sporcular.

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INTRODUCTION

Wrestling is one of the oldest and most prominent Olympic sports globally, with a rich history of competition and development (James, 2009; González, 2013). As a combat sport consisting of two periods totaling 6 minutes, the importance of physical, physiological, and psychological factors in wrestling performance is of paramount significance. With increasing competitiveness and frequent changes in rules, the necessity to refine training programs and enhance wrestlers' technical-tactical parameters has become increasingly critical. Furthermore, understanding the technical-tactical characteristics and performance indicators of modern wrestling is essential for achieving success at the elite level (Chaabene et al., 2017; Latyshev et al., 2020; Yoon, 2002). The World Wrestling Championships represent the most challenging and highly competitive event of the year for elite wrestlers, where athletes are meticulously prepared to achieve peak performance.

Recent modifications to international wrestling rules have aimed to promote more dynamic and offensive wrestling styles. These rule changes are expected to drive the development of novel training methodologies, tactics, and techniques. Additionally, advancements in technology, including big data analytics and artificial intelligence, have heightened the significance of match analysis for coaches and wrestling researchers (Tünnemann, 2011; González, 2014; Chaabene et al. 2017; Mykola et al. 2017). To achieve success in wrestling, it is essential to identify the

fundamental technical-tactical characteristics and reliable, predictive performance indicators throughout each stage of athletic preparation (Mykola et al., 2017). Match analysis offers valuable feedback for coaches by providing objective data regarding athletes' technical-tactical performances. Such feedback enables coaches to optimize training programs and enhance athlete performance effectively (James, 2009; Mykola et al. 2017; Arabacı et al. 2018). In combat sports like wrestling, where direct confrontation with an opponent is central, it is particularly challenging, if not impossible, for coaches to observe and recall all critical events that occur during a match. The same limitation applies to the athletes themselves. Moreover, information gathered solely through observation can be subjective and potentially misleading (Cipriano, 1993; Podlivaev 2010; Farwell and Simpson 2013). According to Tünnemann and Curby (Tünnemann and Curby 2016), enhancing the efficiency of training is a key factor in improving wrestling performance, and effective training management begins with identifying target performance, predicting outcomes, and conducting comprehensive performance analysis.

Technical-tactical actions performed during wrestling matches can be evaluated through notational analysis (also referred to as match analysis), which involves systematically recording significant events to quantify performance in a consistent and reliable manner (Tünnemann and Curby, 2016). The practical utility of notational analysis lies in its ability to provide well-chosen performance determinants,

thereby enabling coaches to identify strengths and weaknesses in athlete or team performance and facilitating comparative analysis (Hughes and Franks, 2007; McGarry et al. 2015). Previous studies have investigated various aspects of wrestling matches (Atan and İmamoğlu 2005; James, 2009; Podlivaev 2010; García-Pallarés et al. 2011; McGarry et al. 2015; Miarka 2016). However, to the best of our knowledge, no study has yet analyzed and compared the technical and tactical aspects of two consecutive Senior World Wrestling Championships held immediately after the Olympic Games. Although previous research has predominantly focused on injuries, ergogenic aids, and the physical and physiological profiles of wrestlers, some authors have addressed the bout characteristics of elite and non-elite wrestlers. Nevertheless, there remains a limited number of studies examining the technical and tactical aspects of super-elite male wrestlers.

The present study aimed to conduct a comprehensive notational analysis of the technical and tactical aspects of elite men's freestyle wrestling in the 2021 and 2022 Senior World Wrestling Championships. It was hypothesized that within each championship year (2021 and 2022), there would be significant differences in technical and tactical performance indicators such as point distribution across periods, frequency of standing versus parterre techniques, and effectiveness of attack versus counter-attack actions.

METHODS

Research Model: This study was designed as a descriptive research model utilizing notational analysis to evaluate the technical and tactical movements performed during the 2021 and 2022 Senior Freestyle Wrestling World Championships.

Purpose of Research: The primary objective of this study was to conduct a detailed comparison of the technical and tactical performance characteristics of wrestlers during these two major international tournaments. Specifically, this research aimed to identify the most frequently used techniques, assess the effectiveness and efficiency of various technical-tactical movements, and determine the differences between successful and unsuccessful performances. Furthermore, the study sought to establish quantitative indicators of technical-tactical performance that contribute to success in elite-level freestyle wrestling, providing valuable insights into training and competition strategies for athletes and coaches.

Research Group: The 2021 and 2022 World Senior Freestyle Wrestling Championships were held in Oslo (2021WC) and Belgrade (2022WC), respectively. A total of 598 bouts (2021WC = 264 bouts; 2022WC = 314 bouts) were examined in terms of nominal technical-tactical movements. All men's senior freestyle weight categories contested at both championships were included: 57 kg, 61 kg, 65 kg, 70 kg, 74 kg, 79 kg, 86 kg, 92 kg, 97 kg, and 125 kg. Individual athlete age data are not reported in the publicly available United World Wrestling results database; therefore, age-specific analyses could not be performed. All wrestlers competed in the senior division as defined by United World Wrestling eligibility regulations, and thus the sample represents elite senior-level competitors.

Data Collection: The matches were analyzed by two researchers who are wrestling coaches and have wrestled for at least ten years. Examined bouts conducted by Dartfish Connect Plus 8.0 video analysis program. Before starting the analysis of 2021WC and 2022WC matches, the two analysts observed ten matches together. After reaching a consensus with the researchers on the points to be considered in the analysis of the matches, they started the analysis of the matches of the world championships. Although inter-rater reliability was not calculated numerically, both researchers analyzed ten matches together prior to the study to ensure consistency and resolve discrepancies in tagging and categorization. A consensus-based protocol was followed throughout the data collection process. Matches analyses were performed according to the following procedure: a) determining the type of analysis to be performed. An example was made for technical-tactical performance analysis, b) Searching and tagging: searching for sequences, actions or behaviors to be analyzed, labelling the behavior, limiting the order, c) creating a database: characterizing each index and producing summary tables, d) data usage: data analysis, presentation results and report preparation.

Technical-tactical combinations, quantitative indicators of technical-tactical performance and technical-tactical indicators of wrestlers were analyzed. Technical-tactical combinations were assessed in two nominal categories: attack and counter-attack movements. Attack coefficient (A/C Coefficient) was calculated by dividing the number of attacks by the number of counter-attacks. Moreover, wrestling techniques were grouped into take downs and throws (wrestling in standing position), flips and throws (wrestling in parterre position). Quantitative indicators of the technical-tactical performance of wrestlers were grouped in three groups. First group, diversity was determined by dividing the techniques by the number of matches (technique/match). Second group, effect was determined by dividing the frequency of the applied technical-tactical combinations by the total number of matches (TTC/match). Third group, efficiency was determined by total points earned in a match based on total wrestling time (points/minute). Technical-tactical indicators were evaluated as standing/parterre coefficient: the number of standing position techniques divided by the number of parterre position techniques and type of struggle: movements were expressed as pushing, pulling and actions. Moreover, points according to time and periods, points earned in standing and parterre wrestling, techniques, winning types, passivity, caution, techniques/match and total technical points/techniques were determined.

The data used in this study were obtained from the 2021 and 2022 Senior Freestyle World Championship competition results and statistics, which are publicly available and published on the official website of United World Wrestling (<https://uww.org>). Therefore, ethics committee approval is not required. The data were last accessed on January 17, 2025.

Analysis of Data: Quantitative and qualitative data of the variables determined in Dartfish Connect Plus 8.0 program were analyzed by transferring them to SPSS for Windows 28 (IMB SPSS, Inc., Chicago, IL) program. The normality of the data was assessed using the Shapiro-Wilk test, and the

results indicated that the data were normally distributed before conducting parametric tests. Independent Samples T, Chi-Square, One Way Anova and Univariate Analysis of Variance tests were used to compare the obtained data. The Bonferroni test was used for pairwise comparisons (Post hoc test). Measures of the effect size for Independent Samples T test were assessed with Cohen's d (ES) - 0.20 small, 0.50 medium and 0.80 large; One-Way Anova Test and Univariate Analysis of Variance were assessed with Partial Eta Squared (η_p^2) - 0.01 small, 0.06 medium and 0.14 large. An alpha $p < 0.05$ was considered statistically significant for all tests.

RESULTS

A total of 54 countries participated in 2021WC and 59 countries participated in 2022WC. Frequencies of attack and counter-attack techniques performed by wrestlers were determined $f = 1021$ (82.1%) and 216 (17.9%) in 2021WC, $f = 1102$ (78.8%) and 297 (21.2%) in 2022WC, respectively. There is statistically significant difference between attack and counter-attacks frequencies in 2021WC and 2022WC ($p < 0.05$; $\chi^2 = 18.033$). Attack/Counter-attack coefficient (A/CA) of 2021WC (4.7) is higher than 2022WC's (3.7). Type of victories determined in 2021WC and 2022WC are %54.5 ($f = 144$) and 60.5% ($f = 190$) by Point, 40.5% ($f = 107$) and 34.4% ($f = 108$) by Technical Superiority, 5.3% ($f = 4.5$) and 5.1% ($f = 16$) by Fall, 0.3% ($f = 1$) and 0% ($f = 0$)

Judgment, respectively ($p > 0.05$; $\chi^2 = 3.681$). In First and Second period are determined Mean Technical points (TPmean) 5.2 and 4.4 ($t = 1.785$, $p > 0.05$, Cohen's $d = .071$) and Mean Technical points according wrestling actions (WAmean) 1.78 and 1.73 ($t = 1.296$, $p > 0.05$, Cohen's $d = .068$) in 2021WC and TPmean 5.1 and 4.4 ($t = 1.713$, $p > 0.05$, Cohen's $d = .061$) and WAmean 1.77 and 1.76 ($t = 0.029$, $p > 0.05$, Cohen's $d = .001$) in 2022WC, respectively. Pull, Action and Push combats frequencies are determined 140 (11.2%), 845 (67.7%) and 149 (18%) in 2021WC, and 40 (%2.9), 1103 (79.5%) and 243 (17.5%) in 2022WC, respectively. There is significant difference between bout combat type frequencies in 2021WC and 2022 ($p < 0.05$, $\chi^2 = 19.810$).

Distribution of techniques and gained technical points in 2021WC and 2022WC are presented in Table 1. The highest and lowest performed techniques per match (Mt) in WC2021 and WC2022 are determined in 86 kg (6.2 tech/match) and 61 kg (6.1 tech/math), and 97 kg (3.8 tech/match) and 70 kg (5 tech/match), respectively. The highest and lowest gained technic points per techniques (Mtp) in WC2021 and WC2022 are determined in 86 kg (1.84 pt/tech) and 70 kg and 92 kg (1.81 pt/tech), 57 kg (pt/tech) and 65 kg and 12 kg (1.73 pt/tech), respectively.

Table 1. Distribution of techniques and gained technical points in 2021WC and 2022WC

Weight		2021WC					2022WC				
	f_{tech}	N_m	M_t	$Total_p$	$M_{tp} \pm SD$		f_{tech}	N_m	M_t	$Total_p$	$M_{tp} \pm SD$
57 kg	145	25	5.8	237	1.63±.67		190	35	5.4	332	1.75±.64
61 kg	178	33	5.4	323	1.82±.56		172	28	6.1	303	1.76±.57
65 kg	135	23	5.9	217	1.79±.72		182	31	5.9	315	1.73±.68
70 kg	232	30	7.7	288	1.68±.76		161	32	5	288	1.81±.76
74 kg	159	32	5	276	1.74±.62		209	39	5.4	369	1.77±.64
79 kg	164	28	5.9	284	1.74±.64		208	36	5.8	368	1.77±.73
86 kg	168	27	6.2	309	1.84±.59		173	34	5.1	306	1.77±.59
92 kg	101	20	5.1	165	1.64±.76		132	26	5.1	239	1.81±.72
97 kg	144	38	3.8	250	1.75±.86		133	26	5.1	234	1.77±.77
125 kg	108	22	4.9	180	1.68±.75		117	27	4.3	202	1.73±.59
Total	1521	264	5.8	2529	1.75±.69		167	31	5.3	2957	1.77±.67
F					1.695						.266

f_{tech} : Frequency of techniques. N_m : Total match in weight categories. M_t : techniques/match. $Total_p$: Gained total technic point. M_{tp} : total technic points/technique. SD: Standard Deviation.

Technical points were scored according matches and wrestling positions of WC2021 and WC2022 are presented in Table 2 and Table 3, respectively. There is no statistically significant difference between scored technical points in WC2021 and WC2022 ($\chi^2 = 1.580$; $p > 0.05$) with a small effect size ($\eta_p^2 = .023$). In the two competitions the most scored point is 2 technical points (69.9% in WC2021 and 71.7% in WC2022). There is significant difference between points scored in standing and parterre position in both

competitions ($p < 0.05$) with a large effect size (WC2021 Cohen's $d = .673$ and WC2022 Cohen's $d = .654$). S/P coefficient of WC2021 (1.93) is higher than WC2022's (1.75). Technical points scored according to bout time are presented in Table 4. There are significant differences between mean technical points according to time in WC2021 (Ftime = 7.425; $\eta_p^2 = .025$ medium) and WC2022 (Ftime = 12.789; $\eta_p^2 = .037$ small).

Table 2. Technical points scored of WC2021 and WC2022 and comparisons

Technical Point	WC2021				WC2022				Chi Square / η_p^2
	f	TP	%	TP/bt	f	TP	%	TP/bt	
1	489	489	19.4	1.9	537	537	18.3	1.7	1.580 / .023
2	883	1766	69.9	6.7	1055	2110	71.7	6.7	
4	66	264	10.5	1	71	284	9.7	0.9	
5	1	5	0.2	0.01	2	10	0.3	0.03	
Total	1439	2524	100	9.6	1665	2941	100	9.4	

TP: Total point. TP/bt: Mean total point per bouts.

Table 3. Technical points scored according to wrestling position and comparisons.

Position	WC2021			WC2022		
	TP / f	M±SD	t / d	TP / f	M±SD	t / d
Standing	1631 / 966	1.70±0.8	6.384*	1851/1109	1.69±0.8	8.457*
Parterre	843/ 433	1.95±0.3	.673	1058/540	1.98±0.2	.654
Total	2474 / 1399	1.77±0.6		2909/1649	1.77±0.5	
S/P Coefficient	1.93			1.75		

S/P Coefficient: Standing-Parterre Coefficient. d: Cohen's d value. SD: Standard Deviation. *There are statistically significant differences (p<0.05)

Table 4. Frequencies of actions gained point and mean technical points.

Time (min)	WC2021			WC2022			F _{time/compet}
	f	M±SD	Pairwise Comp.	f	M±SD	Pairwise Comp.	
1	222	1.9±0.8		219	2±0.8		
2	227	1.7±0.7		321	1.8±0.7		
3	307	1.6±0.7		361	1.6±0.6	1-2,3,4,5,6*	
4	204	1.8±0.6	1-2,3,5,6*	246	1.9±0.6	2-3*	0.442
5	235	1.7±0.7		292	1.7±0.6	3-4*	
6	246	1.7±0.7		233	1.7±0.7		
F _{time} / η_p^2	7.425 / .025			12.789 / .037			

f: frequencies of actions gained point, M: mean technical points. SD: Standard Deviation. *: There are statistically significant differences (p<0.05).

33 different techniques were identified in both championships. These were expressed in a total of 13 different groups, including 6 standing technic groups, 4 parterre technic groups and passivity, caution and challenge. Frequencies and distribution of wrestling techniques are presented in Table 5. Standing position techniques are Take Down, Push to out, Leg Attack, Throws, Heel Tackle and Miscellaneous, parterre techniques are Gut Wrench, bring to danger position, Ankle Lace, Crotch Lift and other techniques are Passive, Caution and Challenge. The most wrestling techniques are performed in standing position (WC2021 61.4% and WC2022 58.6%). The most commonly used technique in standing position in WC 2021 is Push to out (18.8%) while Leg Attack (18.2%) in WC2022. Gut Wrench is the most commonly used technique in the parterre position for both competitions (WC2021 12.5% and WC2022 9.8%).

Means of technical points/match and point/actions according to weight categories are presented in Table 6. There are the highest TPmean in 86 kg (11.4 pt/match) and lowest TPmean in 125 kg (8.2 pt/match) in WC2021 and the highest TPmean in 61 kg (10.8 pt/match) and the lowest TPmean in 125 kg (7.5 pt/match) in WC2022. However, there are not statistically significant differences between weight categories in both WC2001 ($F = 1.695$; $\eta_p^2 = 0.103$, medium) and WC2002 ($F = 0.266$; $\eta_p^2 = 0.038$, small). The highest WAmmean in 92 kg (1.88 pt/action) and lowest WAmmean in 57 kg (1.63 pt/match) in WC2021 and the highest WAmmean in 70 kg and 92 kg (1.81 point/action) and the lowest WAmmean in 65 kg and 125 kg (1.73 pt/action) in WC2022. However, there is no statistically significant difference between weight categories in both WC2001 ($F = 0.195$; $\eta_p^2 = 0.011$, small) and WC2002 ($F = 0.266$; $\eta_p^2 = 0.021$, small).

Table 5. Frequency and distribution of technical movements.

Wrestling Techniques	2021WC (n=264)			2022WC (n=334)			X ²
	f	%	f/match	f	%	f/match	
Standing	885	61.4	3.35	976	58.6	2.92	^a 33.94*
- Take Down (Single/double leg)	198	13.7	1.33	253	15.2	0.76	^c 4.31
- Push to out (Force out)	272	18.8	1.03	251	15.1	0.75	
- Leg Attack (Ankle pick, trip)	256	17.7	0.97	303	18.2	0.91	
- Throws (Arm/hip throw)	71	4.9	0.27	88	5.3	0.26	
- Heel Tackle (Foot sweep)	34	2.4	0.13	49	2.9	0.15	
- Miscellaneous (Counter, other)	57	3.9	0.22	32	1.9	0.10	
Parterre	355	24.6	0.91	414	24.9	1.24	
- Gut Wrench (Waist turn)	180	12.5	0.68	163	9.8	0.49	
- Bring to danger position (Back exposure)	94	6.5	0.36	138	8.3	0.41	
- Ankle Lace (Leg roll)	60	4.2	0.23	89	5.3	0.27	
- Crotch Lift (Lift & turn)	21	1.5	0.08	24	1.4	0.07	
Other	202	14	0.77	275	16.5	0.82	
- Passive (Inactivity point)	138	9.6	0.52	191	11.5	0.57	
- Caution (Illegal move)	31	2.1	0.12	41	2.5	0.12	
- Challenge (Video review)	33	2.3	0.13	43	2.6	0.13	
Total	1442	100	5.47	1665	100	4.99	
^c X ²		844.988*			865.581*		
^d X ²		538.473*			496.436*		

^a: Comparison between 2021WC and 2022WC by all techniques. ^d: Comparison of standing – parterre and other group techniques. ^c: Comparison between 2021WC and 2022WC by standing – parterre and other group techniques. ^e: Comparison of all techniques. *: There are statistically significant differences (p<0.05).

Table 6. Mean of technical points/match according weight categories and actions.

Weight	2021WC					2022WC				
	N _{match}	TP	f _{tech}	TP _{mean}	WA _{mean}	N _{match}	TP	f _{tech}	TP _{mean}	WA _{mean}
57 kg	25	237	145	9.5	1.63	35	332	190	9.5	1.75
61 kg	33	323	177	9.8	1.82	28	303	172	10.8	1.76
65 kg	23	217	121	9.4	1.79	31	315	182	10.2	1.73
70 kg	30	288	171	9.6	1.68	32	288	159	9	1.81
74 kg	32	276	159	8.6	1.74	39	369	209	9.5	1.77
79 kg	28	284	163	10.1	1.74	36	368	208	10.2	1.77
86 kg	27	309	168	11.4	1.84	34	306	173	9	1.77
92 kg	19	165	188	8.7	1.88	26	239	132	9.2	1.81
97 kg	25	250	143	10	1.75	26	234	132	9	1.77
125 kg	22	180	107	8.2	1.68	27	202	117	7.5	1.73
Total	264	2529	1442	9.6	1.75	314	2959	1674	9.4	1.77
F				1.695	0.195				0.266	0.266
η_p^2				0.103	0.011				0.038	0.021

TP_{mean}: Mean technical points /match according weight categories. WA_{mean}: Mean of technical points according to wrestling actions.

DISCUSSION

The primary aim of the present study was to analyze the 2021 and 2022 Senior Freestyle World Championships using notational parameters. While technical-tactical aspects of wrestling have been previously investigated, inconsistencies in findings remain due to changes in rules and evolving training approaches employed by coaches and athletes. The nominal analysis of elite-level wrestlers in high-level competitions provides essential insights and serves as a guide for future training strategies.

The main findings of this study revealed an average of 5.8 techniques per match in the 2021 World Championships (WC) and 5.3 techniques per match in the 2022 WC, with 1.75 points per technique in 2021 and 1.77 points per technique in 2022. The highest average number of techniques was observed in the 86 kg category (2021 WC) and the 61 kg category (2022 WC), while the lowest values were found in the 97 kg and 125 kg categories, respectively. Wrestling techniques were classified into standing position (e.g., takedowns, leg attacks), parterre (e.g., gut wrench), and other techniques (e.g., passive, caution, challenge). In both championships, techniques performed in the standing position were predominant. Takedowns, push-outs, and leg attacks in the standing position, as well as the gut wrench in parterre wrestling, were identified as the most frequently used techniques.

Previous research supports these findings. For instance, Tünnemann and Curby's (2016) reported an increase in the use of leg attacks, takedowns, ankle laces, and gut wrenches during the 2015 World Freestyle Wrestling Championships. Similarly, studies on the 2016 Olympic Games highlighted that leg attacks were the most dominant techniques, followed by the gut wrench and takedown (Tünnemann, 2011). Slacanac et al. (2017) also emphasized the effectiveness of Croatian wrestlers at the European Championship, achieving 5.6 points per match, which was similar to the 6.8 points per match observed at the WCs (Tünnemann, 2016). The present study found that wrestlers employed more attacks than counterattacks, with two-point techniques being the most frequently scored. Technical points scored in the standing position were higher than those achieved in the parterre position. Additionally, most points were earned during the first minute of matches in both the 2021 and 2022 WCs. This finding aligns with previous studies indicating that offensive techniques are more

valuable than counterattacks in freestyle wrestling (Arabaci et al., 2018; Dokmanac et al., 2012; Slacanac et al., 2017; Tünnemann, 2011). Furthermore, it has been suggested that the most powerful athletes are also the most effective attackers (Tünnemann & Curby, 2016).

Latyshev et al. (2020) reported an average of 7.5 points per match in lightweight, 6.0 points in middleweight, and 6.2 points in heavyweight categories during the 2016 Olympic Games. Tünnemann (2016) found similar results, with an average of 7.0 points per match at the 2007 World Championships and 7.0 points per match at the 2008 Olympic Games. In contrast, the present study demonstrated higher average points per match (9.6 in 2021 WC and 9.4 in 2022 WC). This discrepancy may be attributed to rule changes aimed at promoting more active and attractive wrestling, such as adjustments related to passivity. Another notable finding of this study is that victory by points was the most common outcome in both 2021 WC (54.5%) and 2022 WC (60.5%). Arabaci et al. (2018) reported a higher rate of point victories (72.3%) at the 2016 Rio Olympic Games. Our findings indicate no statistically significant difference between the mean technical points (TP_{mean}) and mean technical points per action (WA_{mean}) scored in the first and second periods of both the 2021 and 2022 WCs. Interestingly, TP_{mean} and WA_{mean} were slightly higher in the first period compared to the second period, which may be explained by the fact that wrestlers are less fatigued at the beginning of matches. This observation is consistent with previous studies that reported no significant difference between the points scored in the first and second periods (Arabaci et al., 2018; Tünnemann & Curby, 2016).

This study has several limitations. First, the 2021 WC was held only two months after the Olympic Games, which may have negatively affected the performance and motivation of the wrestlers. Second, Russian wrestlers, a dominant force in wrestling history, were banned from participating in the 2022 WC. Third, referee biases and errors could have influenced the match outcomes. Future studies should analyze women's, Greco-Roman, and youth wrestling matches. Additionally, examining the biomechanical and technical-tactical parameters that contribute to success, especially by comparing medalist and non-medalist wrestlers, could provide valuable insights.

Conclusions

The findings of the present study demonstrated that wrestling bouts in the 2021 and 2022 WCs were characterized by attractive and active combat. Leg attacks, takedowns, push-outs, and gut wrenches were identified as the most effective techniques in elite freestyle wrestling. While there were some differences in technical-tactical parameters (e.g., wrestling position, score, period, techniques, movements, and time) between the two championships, these differences were generally not statistically significant. Therefore, individualized, high-intensity, and well-rounded training programs are essential for athletes aiming to achieve success in elite-level wrestling competitions.

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GENİŞLETİLMİŞ ÖZET

Çalışmanın Amacı

Bu araştırmanın temel amacı, 2021 ve 2022 Büyükler Serbest Güreş Dünya Şampiyonalarında güreşçilerin teknik ve taktiksel performans özellikleri analiz edilerek belirlenmesidir. Çalışmada, elit seviye güreşçilerin en sık uyguladıkları teknikler ve taktiksel yönelimler incelenmiştir. Ayrıca, elit düzeyde serbest güreşte başarıya katkı sağlayan teknik-taktiksel performans göstergelerinin (atak, puan, zamanlama vb.) belirlenmesi amaçlanmıştır.

Araştırma Problemleri

1. 2021 ve 2022 Dünya Şampiyonalarında uygulanan teknik-taktiksel hareketlerdeki farklılıklar nelerdir?
2. Elit seviye güreşte en sık uygulanan teknikler nelerdir ?
3. En çok hangi türde puan alınmıştır ?
4. Elit seviye güreşte pozisyon (ayakta ve parter) açısından en sık uygulanan teknikler nelerdir ?
5. 2021 ve 2022 Dünya Şampiyonalarında uygulanan teknik-taktiksel hareketler hangi dakikalarda daha sık uygulanmıştır?

Literatür Araştırması

Literatür Araştırması Elit düzeyde güreş performansının değerlendirilmesinde, notasyonel analizlerin kullanımı oldukça yaygındır. Bu analizler, müsabakalardaki teknik ve taktiksel hareketlerin nicel olarak değerlendirilmesini sağlar. Güreşte başarıyı belirleyen en önemli unsurlar arasında teknik çeşitliliği, tekniklerin uygulanma sıklığı ve etkinliği, atak ve kontra-atak hareketleri, müsabaka süreleri ve pozisyonlara göre performans yer almaktadır. Literatürde, genellikle serbest güreşte uygulanan ayakta (take down, push to out) ve parter pozisyonundaki (gut wrench, flips) tekniklerin önemine vurgu yapılmaktadır. Ayrıca, atak

katsayısı gibi ölçütler kullanılarak tekniklerin etkinliği incelenmektedir.

Yöntem

Araştırma kapsamında, 2021 ve 2022 Büyükler Serbest Güreş Dünya Şampiyonalarında yapılan toplam 598 karşılaşma (2021: 264; 2022: 314) Dartfish Connect Plus 8.0 video analiz programı kullanılarak incelenmiştir. Karşılaşmalar, iki güreş antrenörü tarafından analiz edilmiştir. Analiz süreci dört aşamada gerçekleştirilmiştir: (1) Teknik-taktiksel performans analizinin belirlenmesi, (2) Arama ve etiketleme: incelenecek hareketlerin belirlenmesi, etiketlenmesi ve sıralanması, (3) Veri tabanı oluşturma: indekslerin karakterize edilmesi ve özet tabloların üretilmesi, (4) Veri kullanımı: analizlerin raporlaştırılması. Teknik-taktiksel kombinasyonlar; saldırı ve karşı saldırı hareketleri olarak iki kategoride değerlendirilmiştir. atak katsayısı, atak hareketlerinin sayısının kontra-atak hareketlerine bölünmesi ile hesaplanmıştır. Güreş teknikleri ayakta ve parter pozisyonlarında uygulanan teknikler olarak gruplandırılmıştır.

Sonuç ve Değerlendirme

Araştırma bulguları, 2021 ve 2022 Dünya Şampiyonalarında güreşin çekişmeli ve dinamik bir mücadele içerdiğini göstermektedir. Ayakta yapılan teknikler her iki şampiyonada da daha sık kullanılmıştır (2021: %61.4; 2022: %58.6). En değerli tekniklerin leg attack, take down, push to out ve gut wrench olduğu tespit edilmiştir. 2021 ve 2022 Dünya Şampiyonaları arasında teknik-taktiksel parametrelerde (müsabaka pozisyonu, puan, periyot, teknikler, hareketler, süre vb.) bazı farklılıklar bulunmakla birlikte, bu farklılıkların çoğu istatistiksel olarak anlamlı değildir. Dolayısıyla, elit düzeyde başarılı olabilmek için bireyselleştirilmiş, yüksek yoğunluklu ve çok yönlü antrenman programlarının uygulanmasının gerekli olduğu söylenebilir.